IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Tae-wan KIM, et al.	Art Unit: 1763
Serial No. 10/713,258	Examiner: Rudy Zervigon
Filed: November 17, 2003	Confirmation No.: *4771*
For: GAS INJECTION APPARATUS FOR SEMICONDUCTOR PROCESSING SYSTEM	Attorney Docket No.: 249/410

TRANSMITTAL OF APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

Sir:

This Appeal Brief is being filed in triplicate together with the fee as set forth in 1.17 (c) in the amount of $500.00 covering the appeal fee. The Commissioner of Patents is hereby authorized to charge the necessary fees to our credit card. Attached is PTO form 2038.

Respectfully submitted,
LEE & MORSE, P.C.

Date: December 13, 2006

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Commissioner for Patents
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Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Date: December 13, 2006

Sir,

INTRODUCTORY COMMENTS

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner of Group 1763 who, in an Office Action Made Final mailed July 13, 2006, finally rejected claims 1-20 in the above-identified application. Appellants respectfully request consideration of this Appeal Brief by the Board of Patent Appeals and Interferences for allowance of these claims in the above-identified application.

I. REAL PARTY IN INTEREST

The invention is assigned to Samsung Electronics Co., Ltd., 416 Maetan-Dong, Paldal-Gu, Suwon-City, Kyungki-Do, Republic of Korea.

II. RELATED APPEALS AND INTERFERENCES

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect, be directly affected by, or have a bearing on, the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-20 are currently pending in the subject application. Claims 1-20 are finally rejected. A copy of claims 1-20 is set forth in the attached Claims Appendix.

Claims 1-20 are on appeal. Of these, claim 1 is the sole independent claim on appeal.

IV. STATUS OF AMENDMENTS

On September 13, 2006, appellants filed a Reply under 37 C.F.R. § 1.116 in response to the Office Action Made Final mailed July 13, 2006. The Reply of September 13, 2006, made no amendments to the claims or the specification, and all amendments that were made prior to the Reply of September 13, 2006, have been entered by the Examiner. Accordingly, the claims set forth in the Claims Appendix correspond exactly to those addressed by the Examiner in the Office Action Made Final mailed July 13, 2006.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claims on appeal generally relate to a gas injection apparatus. Claim 1 is the sole independent claim on appeal.

Claim 1 is directed to a gas injection apparatus comprising an injector, a gas inlet, a manifold, and bifurcating gas channels. An exemplary implementation of such a gas

injection apparatus is illustrated in, e.g., Figure 3a and Figure 5 of the present application, which are reproduced below.

FIG. 3A, the present application

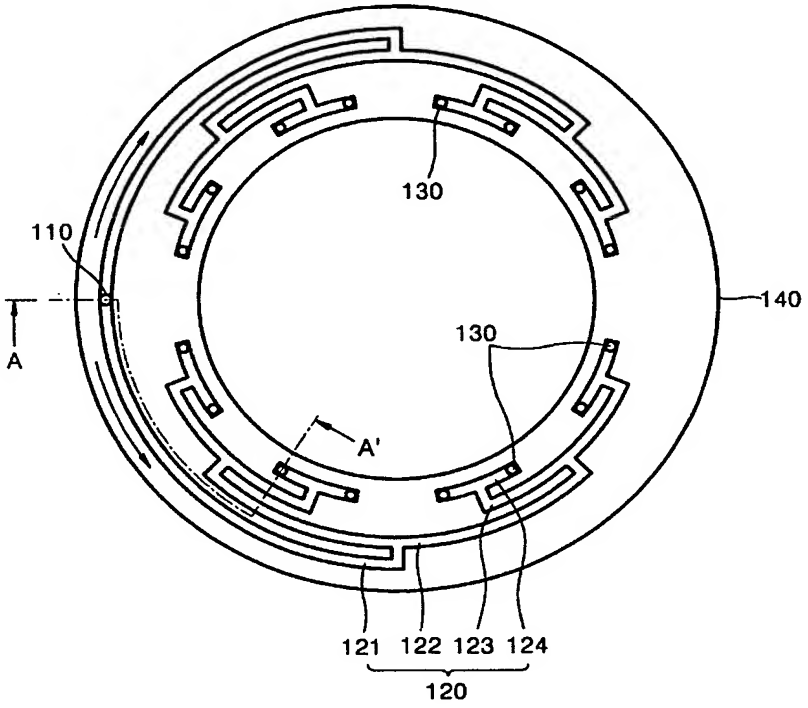
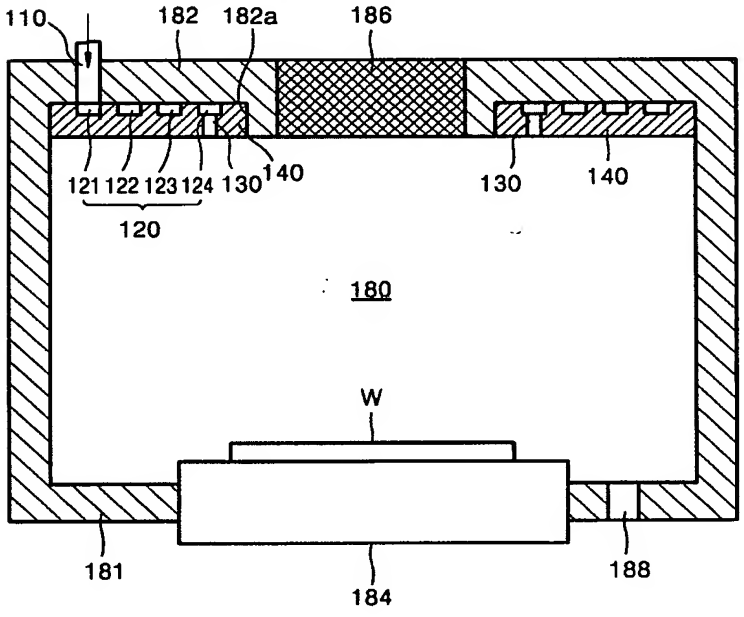


FIG. 5, the present application



The gas injection apparatus recited in claim 1 provides significant advantages over conventional gas injection devices. In particular, the apparatus can be adopted for various kinds of semiconductor processing systems such as PECVD, HDP-CVD, and magnetron sputtering systems. The apparatus can be adopted for a semiconductor processing system having a large reaction chamber to achieve uniform distribution of a reactive gas irrespective of the size of the reaction chamber, gas pressure, and flow rate. Bifurcating gas channels may either be formed in the shape of a groove on the surface of the injector in contact with the inner surface of the wall of the reaction chamber or on the inner surface of the wall of the reaction chamber.

In contrast, a conventional gas injection device having nozzles perpendicular to a substrate is likely to prohibit ion flux flowing to the substrate due to the portions of the nozzles extending toward the interior of the reaction chamber. Further, a conventional showerhead type gas injection apparatus is suitable only for a parallel plate plasma reactor and cannot be applicable to magnetron sputtering systems. A conventional ring-shaped gas injection apparatus creates a difference in pressure of reactive gas at each nozzle due to pressure drops after reactive gas collides with the walls of the gas channels. Moreover, conventional gas channels are not formed in the shape of a groove on the surface of an injector or on the inner surface of the wall of the reaction chamber.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-7, 10-15, and 17-19 stand finally rejected under 35 U.S.C. § 102(b) as being anticipated by WO 01/43857 to Ehrfeld et al. (hereinafter referred to as "the Ehrfeld et al. reference").

Claims 8-9, 16, and 20 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ehrfeld et al. reference in view of U.S. Patent No. 6,001,267 to Os (hereinafter referred to as "the Os reference").

For the purpose of this appeal, appellants present the following ground of rejection for review: whether claim 1, the sole independent claim, is anticipated under 35 U.S.C. § 102(b) by the Ehrfeld et al. reference.

VII. ARGUMENT

In the Office Action Made Final of July 13, 2006, the Examiner rejected claim 1 as being anticipated under section 35 U.S.C. § 102(b) by the Ehrfeld et al. reference. Appellants respectfully submit that this rejection is improper and should be overturned.

The law requires that the Examiner support a section 102(b) rejection by demonstrating that each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.[1] The identical invention must be shown in complete detail as set forth in the claim.[2]

A. Asserted Anticipation Rejection:

In the outstanding Office action, the Examiner rejected claim 1 under 35 U.S.C. § 102(b) as being anticipated by the Ehrfeld et al. reference. Appellants respectfully traverse this rejection, and respectfully submit that the Examiner failed to set forth a *prima facie* case of anticipation for at least the reasons set forth below.

Claim 1 recites,

> A gas injection apparatus for injecting a reactive gas into a reaction chamber of a semiconductor processing system, the apparatus comprising:

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[1] *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ.2d 1051, 1053 (Fed. Cir. 1987).

[2] *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

> an injector disposed to contact an inner surface of a wall of the reaction chamber of the semiconductor processing system, the injector having a plurality of nozzles penetrating it, through which the reactive gas is injected into the reaction chamber;
>
> a gas inlet penetrating through the wall of the reaction chamber;
>
> a manifold disposed between the wall of the reaction chamber and the injector, for supplying the reactive gas flowing through the gas inlet to each of the plurality of nozzles; and
>
> bifurcating gas channels arranged on at least two levels in the manifold, the at least two levels equalizing lengths of gas paths connecting the gas inlet to the plurality of nozzles,
>
> wherein all surfaces defining the gas channels have a full extent defined by a surface of the injector and a surface of the reaction chamber.

1) The Ehrfeld et al. reference fails to show that all surfaces defining the gas channels have a full extent defined by a surface of the injector and a surface of the reaction chamber

In the outstanding Office Action Made Final, the Examiner asserted that the Ehrfeld et al. reference teaches a gas injection apparatus

> ". . . wherein all surfaces (surfaces constituting 5, 2/3, and 4a) defining the gas channels ("bifurcations" conduits; Abstract, not labeled, Figure 2a, b) have a full extent defined by a surface of the injector (2, 3, Figure 2a, b) and a surface of the reaction chamber (inside surface of 1, Figure 2a, b) as claimed by claim 1."

Office Action Made Final of July 13, 2006, at paragraph no. 2, page 3.

Figure 2a, the Ehrfeld et al. reference

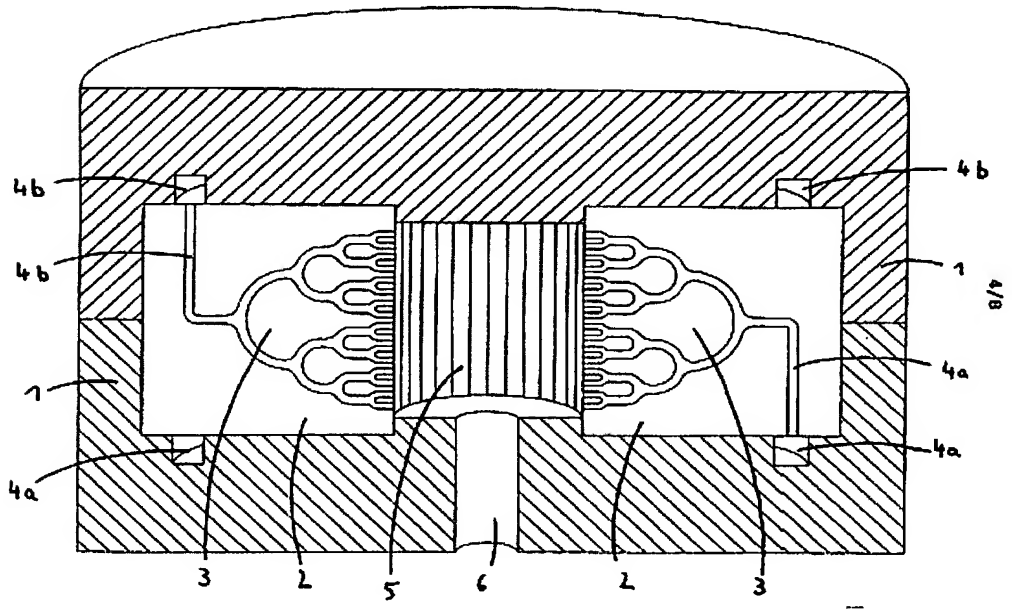
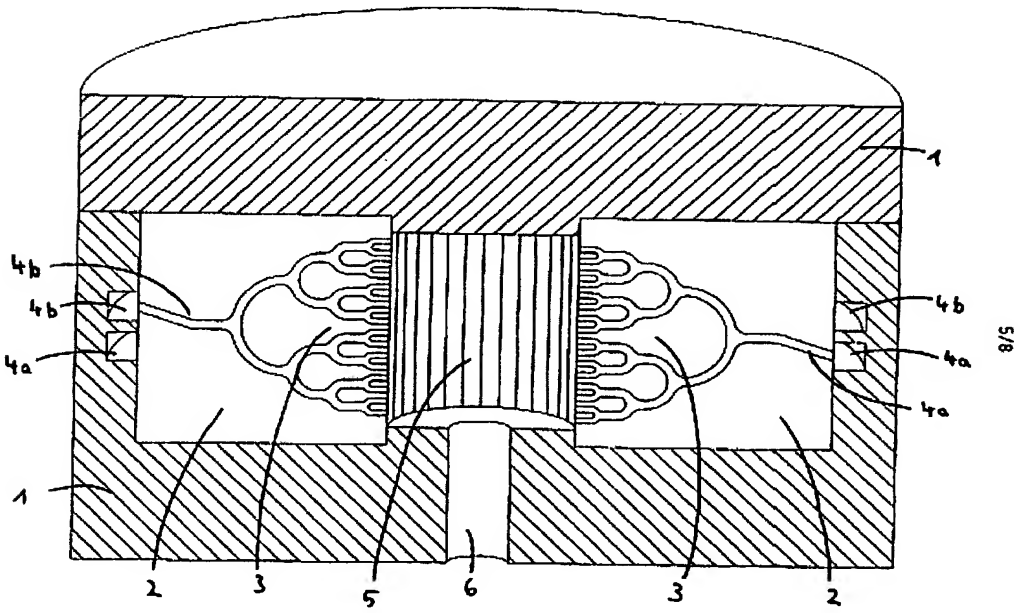


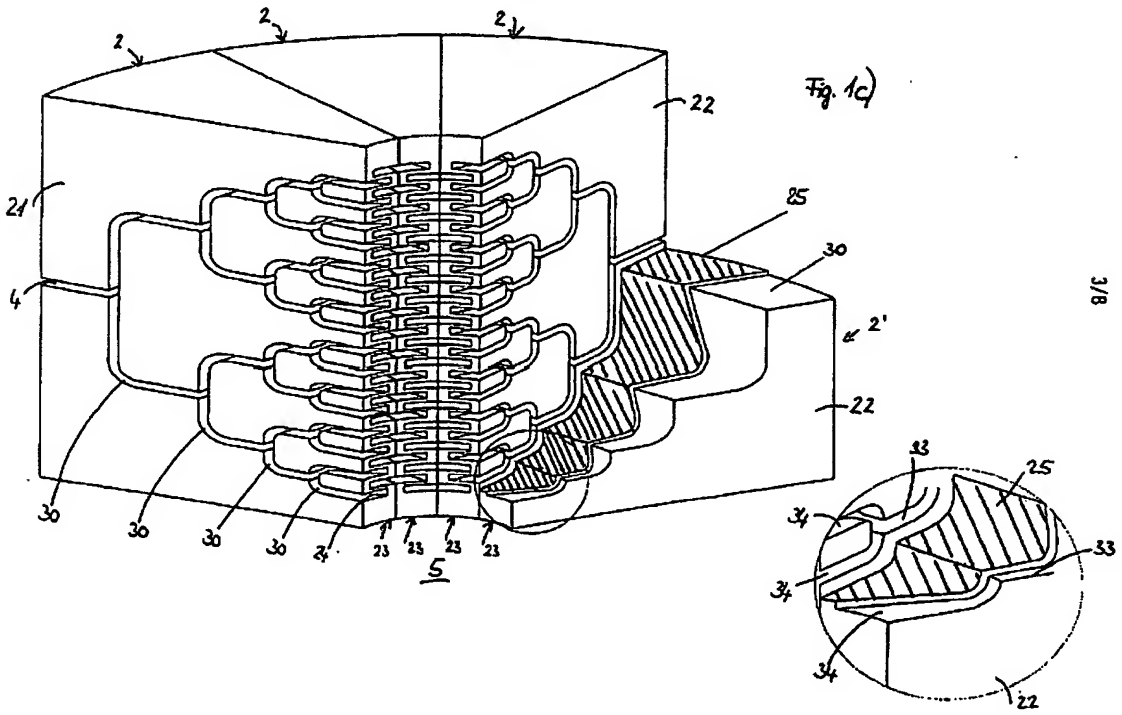
Figure 2b, the Ehrfeld et al. reference



Appellants respectfully disagree with this characterization of the Ehrfeld et al. reference, and respectfully submit that the Ehrfeld et al. reference fails to disclose, or even suggest, each and every element of claim 1.

For example, appellants respectfully submit that the Ehrfeld et al. reference clearly shows that the bifurcations in Figure 2a and Figure 2b are entirely defined by the pie-shaped segments 2 of the injector and not by a surface of the injector and a surface of the reactor chamber, as recited in claim 1. In detail, referring to Figure 1c of the Ehrfeld et al. reference, the bifurcations are carved in a face of a first pie-shaped segment 2. A second, adjacent pie-shaped segment 2 forms an opposing face for the bifurcations, such that, when combined, the *full extent* of the bifurcations is defined *only* by the two adjacent pie-shaped segments 2.

Figure 1c, the Ehrfeld et al. reference



Moreover, contrary to the Examiner's assertion, the inner surface of the reaction chamber 1 in Figure 2a and Figure 2b of the Ehrfeld et al. reference does not define *any portion* of the bifurcations. The inner surface of the reactor chamber is shown by the heavy black lines that outline the inner surface of feature 1 in Figure 2a and Figure 2b,

below. Claim 1 recites that all surfaces defining the gas channels have a full extent defined by a surface of the injector *and* a surface of the reaction chamber. However, in the Ehrfeld et al. reference, *no* extent of the gas channels in the manifold is defined between the injector and the inner surface of the reaction chamber.

Figure 2a, the Ehrfeld et al. reference

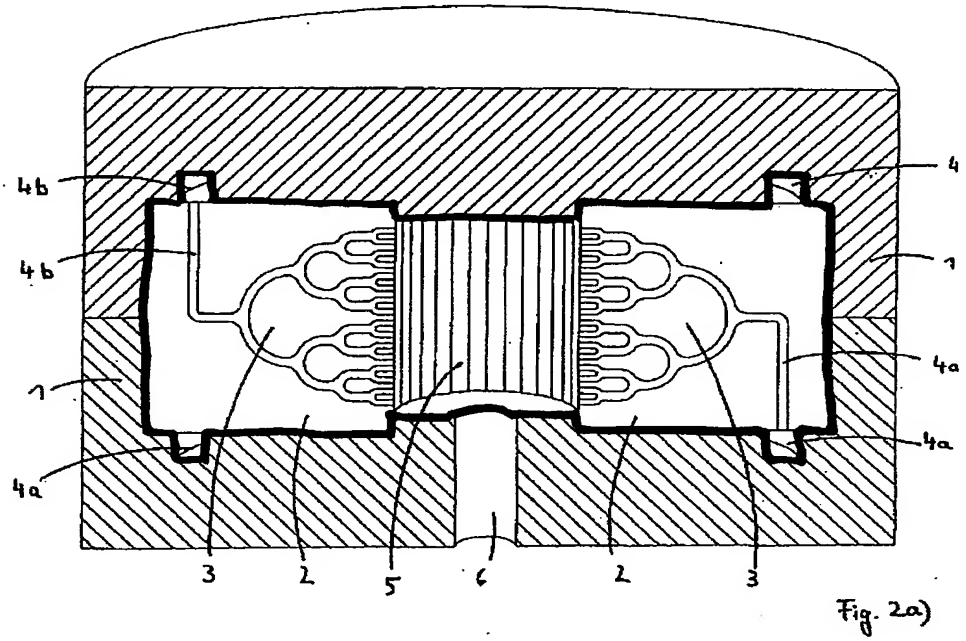
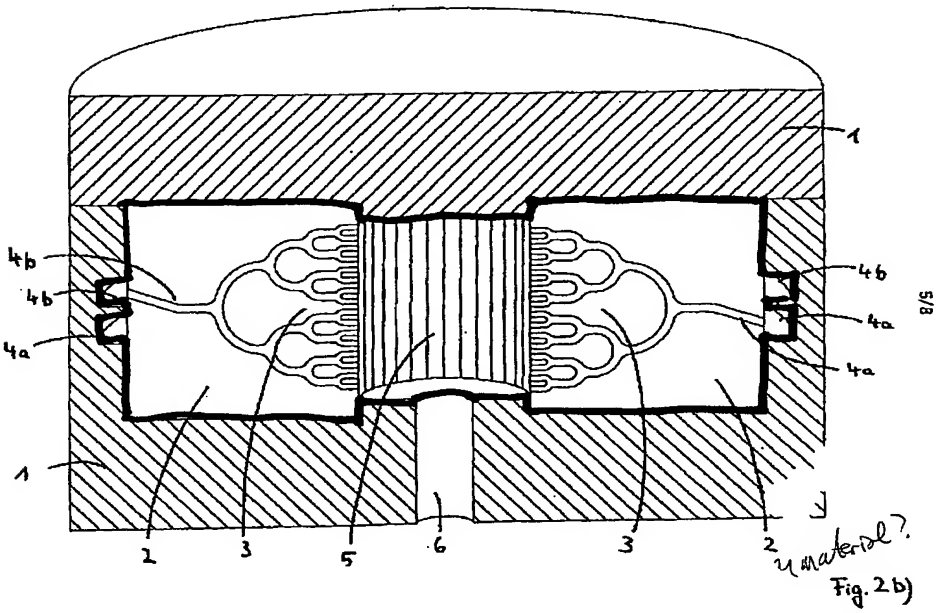


Figure 2b, the Ehrfeld et al. reference



Therefore, since the Ehrfeld et al. reference teaches that the injector segments 2 fully define the bifurcating gas channels in the manifold, and since the inner surface of the reaction chamber 1 does not define any extent of the bifurcating gas channels in the manifold, the Ehrfeld et al. reference fails to teach "bifurcating gas channels arranged on at least two levels in the manifold . . . wherein all surfaces defining the gas channels have a full extent defined by a surface of the injector and a surface of the reaction chamber," as recited in claim 1.

2) The Ehrfeld et al. reference fails to show a manifold disposed between the wall of the reaction chamber and the injector

Moreover, the Ehrfeld et al. reference neither teaches nor suggests "a manifold disposed *between* the wall of the reaction chamber and the injector." As shown in Figure 7 of the application (reproduced below), the present invention provides an injector 340 including a manifold 320 in contact with the sloped inner surface of the upper wall 282 of the reaction chamber 280.

In the embodiment shown in Figure 8 of the application (reproduced below), the manifold 420 is formed in the shape of a groove having a predetermined depth on the sloped inner surface of the upper wall 282 of the reaction chamber 280 instead of along an outer surface of the injector 440. The Ehrfeld et al. reference, in contrast, has its manifold of gas channels entirely within the injector 2, so they are not "between" the wall of the reaction chamber and the injector, as recited in claim 1.

FIG. 7, the present application

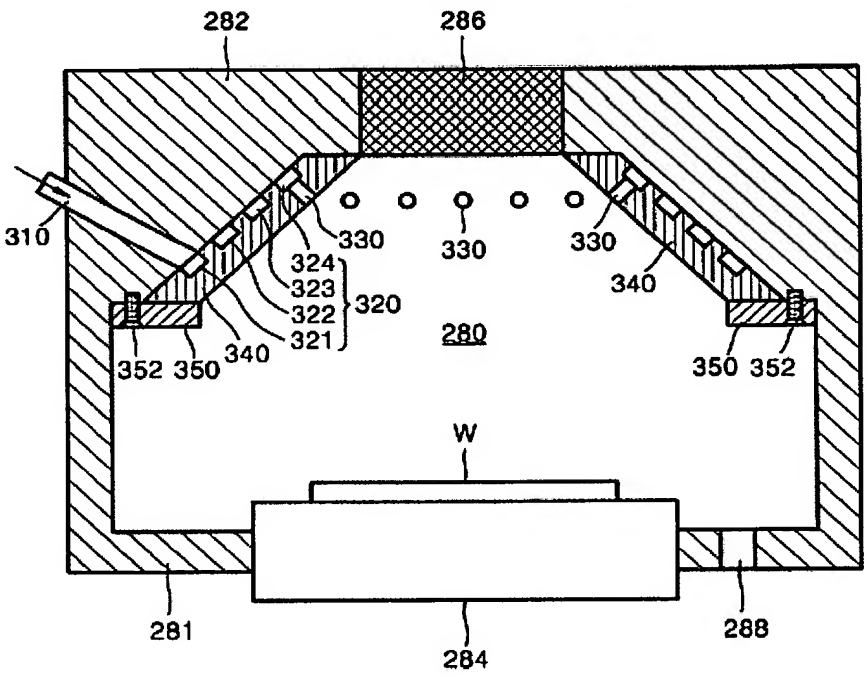
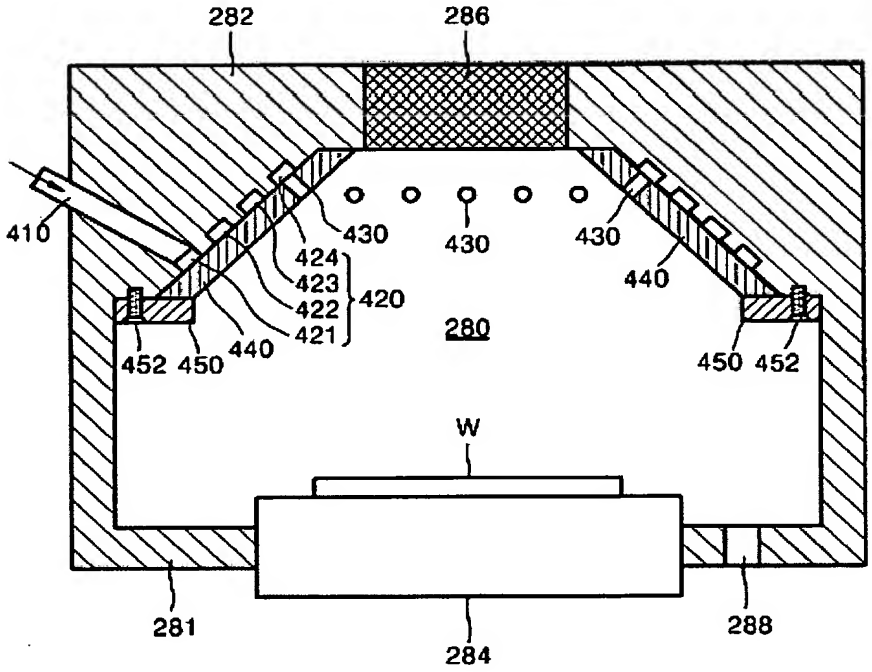


FIG. 8, the present application



CONCLUSION

For at least the reasons set forth above above, appellants respectfully submit that the Ehrfeld et al. reference fails to disclose, or even suggest, each and every element of claim 1. Therefore, the Examiner failed to set forth a *prima facie* case of anticipation with respect to claim 1. Accordingly, claim 1, as well as claims 2-20 depending therefrom, are believed to be allowable over the Ehrfeld et al. reference.

In view of the above, appellants respectfully submit that claim 1 is not anticipated under 35 U.S.C. § 102(b) by the Ehrfeld et al. reference, and respectfully request that the rejection of claim 1 on this ground be overturned.

Respectfully submitted,

LEE & MORSE, P.C.

Date: December 13, 2006

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PETITION and DEPOSIT ACCOUNT CHARGE AUTHORIZATION

This document and any concurrently filed papers are believed to be timely. Should any extension of the term be required, applicant hereby petitions the Director for such extension and requests that any applicable petition fee be charged to Deposit Account No. 50-1645.

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Any additional fee(s) necessary to effect the proper and timely filing of the accompanying-papers may also be charged to Deposit Account No. 50-1645.

VIII. CLAIMS APPENDIX

The pending claims as they stand on appeal are presented in a listing of the claims, below. Claims 1-20 are currently pending in the subject application. Claim 1 is the sole independent claim.

Listing of the Claims:

1. (Previously Presented) A gas injection apparatus for injecting a reactive gas into a reaction chamber of a semiconductor processing system, the apparatus comprising:

an injector disposed to contact an inner surface of a wall of the reaction chamber of the semiconductor processing system, the injector having a plurality of nozzles penetrating it, through which the reactive gas is injected into the reaction chamber;

a gas inlet penetrating through the wall of the reaction chamber;

a manifold disposed between the wall of the reaction chamber and the injector, for supplying the reactive gas flowing through the gas inlet to each of the plurality of nozzles; and

bifurcating gas channels arranged on at least two levels in the manifold, the at least two levels equalizing lengths of gas paths connecting the gas inlet to the plurality of nozzles,

wherein all surfaces defining the gas channels have a full extent defined by a surface of the injector and a surface of the reaction chamber.

2. (Original) The gas injection apparatus as claimed in claim 1, wherein one level of the gas channels of the at least two levels of gas channels is split into two branches at either end of the next higher level of the gas channel, each branch having the same length, the highest level of gas channel is split into two branches, each having the same length at a portion connecting with the gas inlet, and each of the plurality of nozzles is connected to the lowest level of the gas channels.

3. (Original) The gas injection apparatus as claimed in claim 2, wherein the gas channels are arranged on four levels.

4. (Original) The gas injection apparatus as claimed in claim 2, wherein each of the plurality of nozzles is connected at either end of the lowest level of the gas channels.

5. (Original) The gas injection apparatus as claimed in claim 1, wherein a support structure is formed in the inner surface of the wall of the reaction chamber, and the injector is inserted into the support structure.

6. (Original) The gas injection apparatus as claimed in claim 1, wherein the gas channels are formed in the shape of a groove on the surface of the injector in contact with the inner surface of the wall of the reaction chamber.

7. (Original) The gas injection apparatus as claimed in claim 1, wherein the gas channels are formed in the shape of a groove on the inner surface of the wall of the reaction chamber.

8. (Original) The gas injection apparatus as claimed in claim 7, wherein the injector is formed of a dielectric liner.

9. (Original) The gas injection apparatus as claimed in claim 8, wherein the dielectric liner is formed of a ceramic material.

10. (Original) The gas injection apparatus as claimed in claim 1, wherein exits of the plurality of nozzles are evenly spaced on a surface of the injector opposite to an interior of the reaction chamber, along a circumference of the injector.

11. (Original) The gas injection apparatus as claimed in claim 1, wherein the injector is flat and ring-shaped and disposed to contact the bottom of an upper wall of the reaction chamber.

12. (Original) The gas injection apparatus as claimed in claim 11, wherein the gas channels are disposed so that a high-level gas channel relative to the gas inlet is closer to an outer circumference of the injector and a low-level gas channel relative to the gas inlet is closer to an inner circumference of the injector.

13. (Original) The gas injection apparatus as claimed in claim 1, wherein the injector is cylindrical and disposed to contact an inner surface of a sidewall of the reaction chamber.

14. (Original) The gas injection apparatus as claimed in claim 12, wherein the gas channels are disposed on the outer circumference of the injector so that a high-level gas channel relative to the gas inlet is lower in the reaction chamber than a low-level gas channel relative to the gas inlet.

15. (Original) The gas injection apparatus as claimed in claim 1, wherein the injector is conical and disposed to contact a sloped inner surface of an upper wall of the reaction chamber.

16. (Original) The gas injection apparatus as claimed in claim 15, wherein the gas channels are disposed on the outer circumference of the injector so that a high-level gas channel relative to the gas inlet is located lower in the reaction chamber than a low-level gas channel relative to the gas inlet.

17. (Original) The gas injection apparatus as claimed in claim 14, wherein the injector is supported by a support member in the wall of the reaction chamber.

18. (Previously Presented) The gas injection apparatus as claimed in claim 1, further comprising a showerhead injector disposed at the top of the reaction chamber, the showerhead injector supplying the reactive gas towards a center of the reaction chamber.

19. (Original) The gas injection apparatus as claimed in claim 1, wherein two or more reactive gases are mixed when passing through the manifold, and a mixture of the two or more reactive gases are injected into the reaction chamber through the plurality of nozzles.

20. (Original) The gas injection apparatus as claimed in claim 1, wherein the reaction chamber includes a plasma source or magnetron gun.

IX. EVIDENCE APPENDIX

Appellants make no reference to evidence.

X. RELATED PROCEEDINGS APPENDIX

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect, be directly affected by, or have a bearing on, the Board's decision in the pending appeal.

XI. APPENDIX A

U.S. Patent Application Publication No. 2003/0039169 to Ehrfeld et al. appears to be related to the Ehrfeld et al. reference, which was relied upon by the Examiner in the rejection of claims 1-20. The Examiner has not provided an English language translation of the Ehrfeld et al. reference, which was written in German. Thus, U.S. Patent Application Publication No. 2003/0039169 to Ehrfeld et al. may be helpful in this respect.